

Sensitivity of gonococci to antibiotics in strains isolated from 'prostitutes' in Copenhagen

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THE present investigation was performed in order to ascertain whether there is any difference in the sensitivity to antibiotics of gonococci isolated from 'prostitutes' in Copenhagen as compared with that of strains isolated from control cases. Since prostitution in Denmark was prohibited by law in 1906, it is necessary to mention that by 'prostitutes' is meant females without legal employment who have been taken into custody by the police.

Material

In the *Neisseria* Department, Statens Seruminstitut, a case of gonorrhoea in a known patient is registered as a new case if there has been an interval of 3 weeks since the last positive culture of gonococci was obtained. The results of the first sensitivity determination from 269 cases in 209 patients* diagnosed during 1966, 1967, and 1968 form the 'prostitutes' series.

All the strains of gonococci on which sensitivity determination was performed in the *Neisseria* Department, Statens Seruminstitut, Copenhagen, during the same years were used as a control series. These comprised about 3,000 to 4,000 strains per year.

Methods

The two series were studied for each of the three years separately, because the percentage of strains that are less sensitive to penicillin among those sent in with a request for sensitivity determination has been decreasing during recent years.

Fig. 1 (kindly supplied by Dr. Alice Reyn) shows that since 1962 the proportions of strains with decreased sensitivity to penicillin have fallen from 57 to 30 per cent.

Sensitivity determination is performed in the *Neisseria* Department only on request, and the examination for sensitivity to penicillin, tetracycline, and streptomycin is usually carried out by means of a plate-dilution method.

Penicillin

Five concentrations are used in the nutrient plates, which contain from 0.0024 to 0.60 μg . sodium peni-

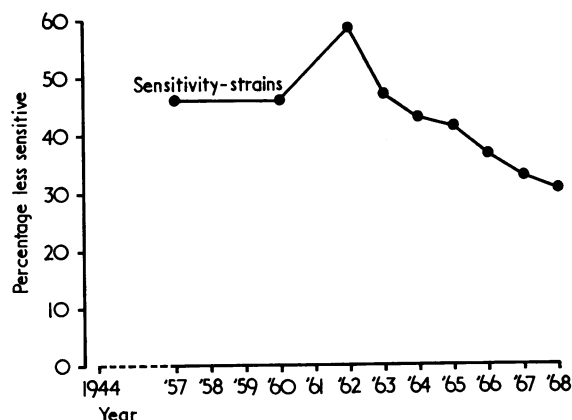


FIG. 1 Incidence of gonococci less sensitive to penicillin, Denmark, 1957-68 (from Reyn, 1969)

cillin G per ml. The concentration of penicillin is increased 4-fold from one plate to the next.

Tetracycline

Three plates are used containing from 0.20 to 3.2 μg . tetracycline per ml.

The growth of gonococci on the various plates is compared with that on control plates without antibiotic. The reading of the results is graded as 0, 1, 2, 3, and 4 degrees of growth. Degree 4 means full growth like that observed on the control plate, and the other figures correspond to lesser degrees of growth. Degree 2 is designated 50 per cent., and the results are stated in terms of the 50 per cent. inhibitory concentrations, or IC_{50} .

If IC_{50} is $\geq 0.005 \mu\text{g}$. penicillin per ml., the strains are considered as being less sensitive to penicillin.

The corresponding value for tetracycline is $\geq 1.13 \mu\text{g}$. per ml. The minimum inhibitory concentration (MIC) would be about twice as high.

Streptomycin]

Only one plate containing 25 μg . per ml. is used, and growth of gonococci on this plate means complete resistance to streptomycin.

*Patients from the V.D. clinic of the Police of Copenhagen (Chief: Inga Christensen, MD) and the Rudolph Berghs Hospital (Chief: Axel Perdrup, MD).

Results

In Table I the 'prostitutes' (P) are compared with the controls (S), showing the percentage of strains less sensitive to penicillin and tetracycline and that resistant to streptomycin.

Penicillin

The immediate impression is that there is a tendency to a higher percentage in the P-strains, particularly in 1966, but the difference is not statistically significant.

Streptomycin

In 1966 the percentage of P-strains resistant to streptomycin is significantly higher than that of the S-strains. In 1967 and 1968 the percentages of P-strains are lower, but not significantly so.

Tetracycline

The percentages of S-strains and P-strains are almost the same. There were somewhat more P-strains in 1966 and slightly fewer in 1967 and 1968.

Although the overall percentage of strains with decreased sensitivity to penicillin is equal in the P- and S-strains, the distribution might be different on the basis of the individual IC_{50} values observed. Fig. 2

(also from Dr. Reyn's work) shows the percentage distribution of S-strains according to the IC_{50} values for penicillin observed in 1963 and 1968, ranging from 0.0012 to ≥ 1.40 $\mu\text{g./ml.}$ The vertical dotted line indicates the limit between sensitive and less

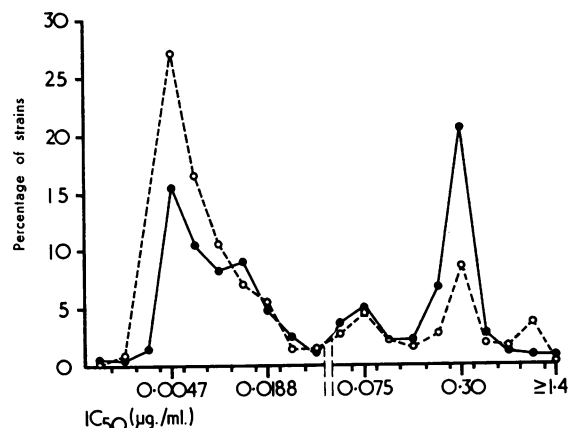


FIG. 2 Percentage distribution of S-strains of gonococci according to IC_{50} values in 1963 and 1968 (from Reyn, 1969)

●—● 1963 (2032 strains) ○---○ 1968 (4246 strains)

TABLE I Comparison of gonococcal strains isolated from 'prostitutes' in Copenhagen with strains sent in with request for sensitivity determination

Year	Total		Penicillin (Per cent. less sensitivity)		Streptomycin (Per cent. resistant)		Tetracycline (Per cent. less sensitivity)	
	S ¹	P ²	S	P	S	P	S	P
1966	2,632	106	36.2	44.3	20.9	30.2*	13.5	15.1
1967	3,447	95	32.5	35.8	20.3	16.8	9.6	6.3
1968	4,246	68	30.0	33.8	20.3	19.1	10.2	7.3

¹ Strains sent in with request for sensitivity determination.

² Strains isolated from 'prostitutes' in Copenhagen.

* Significant deviation from control series ($P = 0.02$).

TABLE II Interrelation of antibiotic sensitivity of gonococcal strains in S and P strains, 1968

Penicillin	Tetracycline	Streptomycin	Cases tested			
			Number		Percentage	
			S	P	S	P
Sensitive	Sensitive	Sensitive	2,942	45	69.3	66
		Resistant	31	0	0.7	0
	Less sensitive	Sensitive	0	0	0.0	0
		Resistant	0	0	0.0	0
Less sensitive	Sensitive	Sensitive	411	10	9.7	15
		Resistant	430	8	10.1	12
	Less sensitive	Sensitive	30	0	0.7	0
		Resistant	402	5	9.5	7
Total			4,246	68	100	100

sensitive strains. In each year there are two peaks at about 0.005 and 0.30 $\mu\text{g./ml.}$ and a smaller peak at 0.075 $\mu\text{g./ml.}$ In 1968 the percentage of sensitive strains has increased in relation to 1963, and a small peak has appeared at 1 $\mu\text{g./ml.}$ In 1968 the percentage of strains less sensitive to penicillin was 30 as against 47 in 1963.

When the strains isolated from 'prostitutes' were analysed in the same way, and the distributions compared with those of the S-strains in the years 1966, 1967, and 1968, they were found to be almost identical.

It is usually found that decreased sensitivity of gonococci to penicillin is combined with resistance to streptomycin and decreased sensitivity to tetracycline. About two-thirds of strains with decreased sensitivity to penicillin are resistant to streptomycin, and of these about one-third are less sensitive to tetracycline. The two series of strains were divided into two groups according to their sensitivity to penicillin, then into four groups according to their sensitivity to tetracycline, and finally into eight groups according to their response to streptomycin. The results for 1968 (Table II) show that the sensitivity pattern is essentially the same for both the S- and P-strains.

Summary

A survey was conducted to determine whether strains of gonococci isolated from Danish 'prostitutes' in 1966, 1967, 1968, included a higher proportion less sensitive to antibiotics than did 'routine' strains sent to the Statens Seruminstitut with a request for sensitivity determination during the same year. Isolates were tested at the Neisseria Department, Statens

Seruminstitut, against penicillin, tetracycline, and streptomycin by the plate-dilution method. It was found that percentages of strains less sensitive to penicillin, tetracycline and streptomycin did not differ significantly in the two groups; in 1966 the proportion of streptomycin-resistant gonococci was significantly higher in the prostitute group, but this isolated phenomenon is not considered to be important.

Reference

REYN, A. (1969). 'Symposium om Riktad och Kontrollerad Terapi med Penicilliner, Lidingö, 1969' (Astra Läkemedel AB), pp. 85-94. Bröderna Ekstrans Tryckeri AB, Lund.

La sensibilité aux antibiotiques des souches de gonocoques isolées chez les 'prostituées' à Copenhague

SOMMAIRE

Une enquête fut effectuée pour savoir si les souches de gonocoques isolées chez les prostituées danoises en 1966, 1967, 1968, étaient proportionnellement moins sensibles aux antibiotiques que celles qui étaient envoyées au Statens Serum Institut pour étude de la sensibilité pendant l'année considérée. Ces souches ont été examinées dans le Département de Neisseria du Statens Seruminstitut, par la méthode des dilutions sur plaque, vis-à-vis de la pénicilline, de la tétracycline et de la streptomycine. On constata que le pourcentage des souches moins sensibles à pénicilline, tétracycline et streptomycine, ne présentait pas de différence significative pour les deux groupes; en 1966, la proportion des gonocoques résistants à la streptomycine fut significativement plus élevée pour le groupe des prostituées, mais ce phénomène isolé n'est pas considéré comme étant important.